

**MISSOURI DEPARTMENT OF NATURAL RESOURCES  
AIR AND LAND PROTECTION DIVISION  
ENVIRONMENTAL SERVICES PROGRAM  
Standard Operating Procedure**

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SOP TITLE: Use, Cleaning and Maintenance of ISCO Automatic Samplers

WRITTEN BY: David Gullic, Water Quality Monitoring Section, ESP

APPROVED BY: Earl Pabst, Director, Environmental Services Program

SUMMARY OF REVISIONS: Sections added for ISCO Models 2900, 2910 and 6700

APPLICABILITY: The procedures outlined in this SOP apply to all ESP personnel who collect water samples with ISCO automatic sampling equipment.

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## 1.0 SCOPE , APPLICABILITY AND ORGANIZATION

This Standard Operating Procedure (SOP) provides Environmental Services Program (ESP) staff with guidance on use and maintenance of ISCO automatic samplers. Specifically, the following topics are included in this SOP:

- General overview and considerations of the ISCO samplers (Sections 4 and 5)
- Operation and maintenance of the ISCO Model 1580 composite sampler (Section 6)
- Operation and maintenance of the ISCO Model 1680 sequential sampler (Section 7)
- Operation and maintenance of the ISCO Model 2710 and 2910 composite samplers (Section 8)
- Operation and maintenance of the ISCO Model 2700 and 2900 sequential samplers (Section 9)
- Operation and maintenance of the ISCO Model 6700 sequential sampler (Section 10)
- Cleaning/set-up procedures for organic sampling (Section 11)
- General cleaning procedures for ISCO samplers (Section 12)
- Set-up procedures for cold weather sampling (Section 13)

## 2.0 PERSONNEL QUALIFICATIONS

Field personnel must have a working knowledge of field sample collection procedures. Staff shall have, at a minimum, attended the department-sponsored Inspection and Enforcement training, Basic Sampling Workshop, or received training from another MDNR employee knowledgeable on proper sample collection procedures.

## 3.0 HEALTH AND SAFETY

Field activities involving the collection of water samples may involve working in or around various waste streams. Field personnel should protect themselves by wearing the appropriate level of personal protective equipment such as disposable gloves and waders. Field staff may also want to participate in MDNR's Medical Monitoring Program.

## 4.0 GENERAL OVERVIEW

### 4.1 Advantages of Using an Automatic Sampler

- 4.1.1 This equipment can be programmed to collect water samples without the sampling personnel having to be present.
- 4.1.2 When using this equipment for composite sampling, the sample is actually comprised of several collections made over a specified period of time or flow. Therefore, the sample is more representative of the water in question than any single grab sample.
- 4.1.3 The samplers can be used in a wide variety of circumstances. Their primary function in the ESP is to collect composite samples for compliance monitoring. However, they can be set up to collect

priority pollutants and other organics with minimal contamination possibilities. They can be programmed to synchronize with real clock time, which is valuable in time-of-travel dye studies. A liquid level actuator can be attached that allows a sample to be collected when a predetermined water level is achieved. In addition, they can be used with a compatible flow meter to collect flow-proportioned samples. These are just a few examples of the sampler's capabilities. The programming instructions included in this SOP are for composite or sequential samples collected at equal increments of time. Other techniques are considered advanced programming skills and are not discussed in this SOP. Refer to the manufacturer's instruction manual for more information.

## 4.2 Background Information

- 4.2.1 The Instrumentation Specialties Company (ISCO) manufactures all of the samplers used by ESP, which includes seven different models. Models 1580, 2710, and 2910 are typically used as composite samplers. Models 1680, 2700, 2900 and 6700 are primarily used as sequential samplers.
- 4.2.2 The basic components of each sampler includes a control panel/control box, a peristaltic pump, a power source, sample intake tubing and strainer, sample container(s), and a base section or tub (refer to Figure 1). The primary difference among the samplers is found in the control box configuration, the physical size of the sampler, and the number/size of sample containers.
- 4.2.3 Automatic samplers currently utilized by ESP staff can generally be divided into two categories; composite and sequential (discrete) samplers. Composite samplers place each aliquot into a single bottle. Sequential or discrete samplers place one or more aliquots into individual bottles (refer to Figure 2). The specific data needs determine which type of sampler is used.
- 4.2.4 Each sampler is capable of keeping the collected sample cool. This is accomplished by placing ice inside the base section, around the sample container(s). This procedure is not included in the operating instructions, but is considered necessary in most sampling situations.
- 4.2.5 Certain precautions should be taken when transporting and placing samplers in the field. The larger units are very bulky and all of the samplers tend to be 'top heavy'. Thus, they tip easily. The samplers need to be secured when transporting and must be placed on level surfaces when sampling.

- 4.2.6 The samplers should be fixed to a secure object (tree, post, etc.) when placed by a stream. A heavy rainfall can result in a sampler being washed downstream.
- 4.2.7 When sampling in an unsecured area, be aware of the possibility of vandalism. Try to place the sampler where it will not be readily visible. In certain circumstances, a decision to collect a grab sample may be preferable to risking the destruction of the equipment by vandals.

## 5.0 SAMPLING CONSIDERATIONS

- 5.1 To determine the volumetric delivery of the pump, the sampler counts the revolutions of the pump rotor. The volume is dependent on the suction head, the suction line length, and nominal sample volume programmed. For a given suction head, suction line and nominal volume, the sampler program has an established relationship as to how much volume one rotation of the pump will deliver. However, other factors such as atmospheric pressure, installation of the pump-tubing, etc. can effect the volume of sample delivered. Therefore, the volume is an approximation even when the sampler is programmed correctly. The repeatability of a sample volume will typically be within +/- 10 milliliters.
- 5.2 Two power sources are typically used to operate the ISCO sampler. The first is an AC power pack, which is used with a regular electrical outlet. Many facilities have outlets near the sampling site that can be used. If no outlet is available, a NICAD battery supplied by ISCO is utilized. (Note: A 12-volt lead acid battery can also be used if necessary)
- 5.3 It is generally a good idea to rinse the sample tubing with water to be sampled. This can be done by manually collecting a sample before starting the sampling program. This is accomplished in different ways depending on the type of sampler used. Keep in mind that if water is actually deposited in the sample container during this process, it should be removed before initiating the sampling program.
- 5.4 On occasion samplers do get submerged while in the field. If this happens, bring the unit to the lab as soon as possible. DO NOT dump the water out of the control box. As long as the circuitry is under water, corrosion will not occur.
- 5.5 The appropriate containers, intake lines, and weighted intakes must be used depending on analyses to be performed. For example, when organics are to be analyzed, properly cleaned glass containers, Teflon intake lines,

and Teflon or stainless steel weighted intake screens must be used (see Section 11). Refer to MDNR-FSS-001 for a more detailed discussion.

- 5.6 When placing the intake line, suspend it at mid-depth in the waste stream to obtain as representative a sample as possible. Avoid placing the line on the bottom or next to sides of the discharge, especially if solids are present. In addition, avoid back-eddies or any other areas that appear to be different from the main discharge.
- 5.7 Samplers that are clean and field ready are to be stored on the appropriate storage shelf with the strainer placed **inside** the top cover. The strainer should be placed outside the top cover on dirty samplers. Dirty samplers should never be placed on the storage shelf.

## 6.0 MODEL 1580 COMPOSITE SAMPLER

- 6.1 It is suggested that you have a sampler present while reviewing these instructions to facilitate learning. Please note that a photograph of the Model 1580 control panel is included as Figure 3. If you have questions after reviewing these procedures, refer to the manufacturer's instruction manual.
- 6.2 The Model 1580 sampler is a composite sampler. The unit is routinely used for compliance monitoring at various wastewater treatment facilities.
- 6.3 Control Panel
  - 6.3.1 The PUMP switch has four positions: Off, Rev., Fwd. and Auto. Placing the knob in the Rev. or Fwd. Positions will cause the pump to continuously expel or draw fluids. Placing the switch in the Auto Position will cause automatic sampling to begin.
  - 6.3.2 The MODE switch determines whether the samples will be collected according to specified time intervals or according to an external signal from a flow meter. (Note: For instructions on collecting samples with a flow meter, refer to pages 1-2 in the instruction manual.)
  - 6.3.3 The SAMPLE RATE selector is used in specifying time intervals between samples. There are seven settings ranging from 2.5 to 160 minutes.
  - 6.3.4 The TIME INTERVAL MULTIPLIER switch is used in conjunction with the SAMPLE RATE selector to specify the time between samples. It has settings from 1.0 to 2.0 and is a multiplying factor (i.e. if the multiplier is set on 2.0, this will

double the time interval indicated on the SAMPLE RATE selector) This allows the time interval between samples to be set for anything between 2.5 and 320 minutes. Example: If a sample is to be collected every 40 minutes, set the SAMPLE RATE selector to 40 and the MULTIPLIER to 1.0 ( $1.0 \times 40 = 40$ ). If you wanted to collect a sample every 60 minutes, set the SAMPLE RATE switch to 40 and the MULTIPLIER to 1.5 ( $1.5 \times 40 = 60$ ).

- 6.3.5 The VOLUME SELECTOR switch is used to select the approximate volume of sample the pump will deliver. To help determine the setting, there is a volume chart located beneath the switch. First estimate the volume head, also referred to as the suction head. This is the vertical distance the sample is lifted from the liquid's surface to the pump. Do not confuse this with suction line length, which includes horizontal components. Next, reading to the left from the column labeled *head ft.*, choose the volume per sample in milliliters for the sampler to collect during each cycle.
- 6.3.6 The SUCTION LINE LENGTH switch has six length settings each for two tubing diameters (3/8" and 1/4"-ID). Currently, most tubing used by WQMS staff is 3/8" diameter. Set the knob to the reading that most closely corresponds to the tubing being used.

#### 6.4 Example of Typical Sampling Program Using a Model 1580

- 6.4.1 Set PUMP switch to Off position and connect power source.
- 6.4.2 Set MODE switch to Time position.
- 6.4.3 Determine suction head and set VOLUME SELECTOR to desired position using the volume chart.
- 6.4.4 Set the SUCTION LINE LENGTH switch to appropriate setting.
- 6.4.5 Set the SAMPLE RATE selector and TIME INTERVAL MULTIPLIER to desired settings.
- 6.4.6 Set the PUMP switch to Auto.
- 6.4.7 Rotating the SAMPLE RATE switch clockwise to the *Manual Cycle* position will manually start a cycle. This will activate the pump to collect a sample according to the programmed information. Immediately return the switch to the previously chosen time setting or the sampler will continuously collect samples. Manually activating the sampler allows you to visually

check the volume of sample being collected and also is an assurance that the sampler is functioning properly.

#### 6.5 Maintenance of the Model 1580

- 6.5.1 The bronze bearings in the pump housing should be lubricated at regular intervals. This can be easily accomplished by spraying the bearings with silicone lubricant each time the pump tubing is changed.
- 6.5.2 If the HUMIDITY INDICATOR (located on the control box) indicates the presence of moisture inside the control box, the control box should be inspected to determine if there is a leak and if the desiccant should be renewed. Refer to the instruction manual for instructions on when and how to renew or replace desiccant.
- 6.5.3 If an automatic sampler will not function in any mode, try replacing the external fuse with a 2 amp, "slo-blo". A second possibility is a defective power source. If neither of these suggestions produce results, contact WQMS staff.

#### 7.0 MODEL 1680 SEQUENTIAL SAMPLER (contains 28 individual bottles)

- 7.1 It is suggested that you have a sampler present while reviewing these instructions in order to facilitate learning. Please note that a photograph of the Model 1680 control panel is included as Figure 4. If you have questions after reviewing these procedures, refer to the manufacturer's instruction manual.
- 7.2 The Model 1680 is a sequential sampler that contains 28 individual bottles. WQMS staff utilize this unit when discrete samples are preferred.
- 7.3 Control Panel
  - 7.3.1 The SAMPLE INTERVAL switch is a three digit push-button switch used to set the time interval between samples. It can be set for any interval between 1 and 999 minutes. Each digit has two push buttons. The upper push-button subtracts one count and the lower push-button adds one count.
  - 7.3.2 The COUNTDOWN L.E.D. displays the number of minutes to the next sample collection. This display is usually turned off and can be lit by depressing the PRESS TO READ DISPLAY push-button.
  - 7.3.3 The PRESS TO READ DISPLAY push-button will activate the L.E.D. display for approximately 30 seconds and then shut off.

- 7.3.4 The PRESS TO SET DELAY TO FIRST SAMPLE push-button is used to start the countdown of the time interval between samples. Changing the SAMPLE INTERVAL switch will not reset the timer. This button must be pushed to start a new countdown.
- 7.3.5 The PUMP switch has four positions: Off, Fwd, Rev, and Auto. The Fwd and Rev positions will cause the sampler to continuously draw or expel fluids, respectively. The Auto setting is used for the automatic sampling sequence. The knob must be in this position for the controls and displays to be operative for programming. Also, be aware of the fact that placing the ISCO Sampler in the Auto mode will cause the rotating distributor funnel to advance one position. The significance of this will be explained later.
- 7.3.6 The SUCTION LINE LENGTH switch has six settings each for ¼" and 3/8" ID diameter tubing. The settings range from 3.5' to 44'. The switch should be set to the reading that most closely corresponds to the tubing diameter and length being used.
- 7.3.7 The VOLUME SELECTOR switch is used to select the volume of liquid to be delivered during each collection. Using the chart below the knob, locate the suction head reading that applies to your sampling situation and set the switch to the desired volume per sample for each cycle.
- 7.3.8 The MODE switch determines whether samples will be collected according to specified time intervals or according to an external signal from a flow meter. Per the scope of this SOP, the MODE switch should be set to time.
- 7.3.9 The MANUAL ADVANCE button – Each time the button is depressed and released, the distributor funnel plate advances one bottle. When the MANUAL ADVANCE button is depressed continuously, it causes the distributor funnel plate to advance to the standby position. Once in the standby position, the pump will not activate and therefore the distributor funnel plate will not advance even if the pump switch is moved to the auto position. It is recommended that you complete the programming instructions while in the standby position. Once the sample programming has completed, depress and release the manual advance button to advance the distributor funnel plate to the first bottle. The bottle number in the viewing port indicates the position of the distributor funnel plate.



- 7.3.10 The MULTIPLEX MODE switch is a two-position toggle switch. In the bottles per sample position, the sampler can fill up to four bottles with one aliquot. In the samples per bottle position, the sampler can place up to four aliquots into each of the 28 bottles.
- 7.3.11 The MULTIPLEX NUMBER OF BOTTLES OR SAMPLES switch is used in conjunction with the MULTIPLEX MODE switch. This four-position switch will designate how many bottles per sample or samples per bottle will be collected.

#### 7.4 Example of a Typical Sampling Program Using a Model 1680

- 7.4.1 Set the PUMP switch to the Auto position and connect the power source.
- 7.4.2 Continuously depress the MANUAL ADVANCE button until the funnel plate is in the standby position.
- 7.4.3 Determine the suction head and set the VOLUME SELECTOR switch to the desired position using the Volume Chart.
- 7.4.4 Set the SUCTION LINE LENGTH to the appropriate setting.
- 7.4.5 Set the MODE switch to the Time setting.
- 7.4.6 Set the MULTIPLEX MODE switch to Samples Per Bottle and the MULTIPLEX NUMBER OF BOTTLES OR SAMPLES to one.
- 7.4.7 Set the SAMPLE INTERVAL switch to the desired time setting.
- 7.4.8 Press the MANUAL ADVANCE button and release. The number in the viewing port should be 1, indicating that the funnel plate is over bottle 1.
- 7.4.9 Simultaneously depress the PRESS TO SET DELAY button and the PRESS TO READ DISPLAY button. This will reset the countdown timer for the interval between samples. This will also cause the ISCO to collect a manual sample according to the programmed instructions. This allows the visual check of sample volume and is an assurance that the sampler is functioning properly.

#### 7.5 Maintenance Procedure for the Model 1680

- 7.5.1 The bronze bearings in the pump housing should be lubricated at regular intervals. This can be easily accomplished by spraying the

bearings with silicone lubricant each time the pump tubing is changed.

- 7.5.2 If the HUMIDITY INDICATOR (located on the control box) indicates the presence of moisture inside the control box, the control box should be inspected to determine if there is a leak and if the desiccant should be renewed. Refer to the instruction manual for instructions on when and how to renew or replace desiccant.
- 7.5.3 If an automatic sampler will not function in any mode, try replacing the external fuse with a 2-amp “slo-blo”. A second possibility is a defective power source. If neither of these suggestions produce results, contact WQMS staff.
- 7.5.4 If the distributor funnel plate is not aligned properly (the funnel plate stops advancing or the sample aliquot is being deposited in-between bottles) request assistance from WQMS staff.  
Adjustments can be made in the funnel key using an allen wrench.

## 8.0 MODEL 2710 and 2910 COMPOSITE SAMPLER

- 8.1 It is suggested that you have a sampler present while reviewing these instructions in order to facilitate learning. Photographs of the Model 2710 and 2910 control panels are included as Figures 6 and 8, respectively. If you have questions after reviewing these procedures, refer to the manufacturer’s instruction manual.
- 8.2 Models 2710 and 2910 are both discussed in this section because they are utilized for similar applications. In addition, the control panels and programming options are very similar.
- 8.3 The Model 2710 and 2910 are utilized to collect composite samples. The units are used almost exclusively for compliance monitoring at wastewater treatment plants.
- 8.4 Manual Controls – The left column of six blue keys are the manual controls
  - 8.4.1 Pressing the MANUAL SAMPLE key while the sampler is in the standby state will cause a sample to be collected according to the sampler’s current program.
  - 8.4.2 Pressing the PUMP JOG FORWARD key will cause the pump to draw fluids as long as the key is depressed.

- 8.4.3 Pressing the PUMP JOG REVERSE key will cause the pump to expel fluids as long as the key is depressed.
- 8.4.4 Pressing the PUMP CONTINUOUS FORWARD key will cause the pump to draw fluids continuously. The sampler must be in the standby state.
- 8.4.5 Pressing the PUMP CONTINUOUS REVERSE key will cause the pump to expel fluids continuously. The sampler must be in the standby state.
- 8.4.6 Pressing the PUMP STOP KEY will cause the pump to stop immediately. (Note: this key is red on the Model 2910).

Note: The PUMP JOG FWD, PUMP JOG REV, and PUMP STOP keys will all work in either the standby or program state. This enables you to manually calibrate a sample when volumes are critical. Manual calibration is explained in the instruction manuals.

- 8.5 Numeric Keypad – The twelve keys in the center of the control panel make up the numeric keypad. These turn the sampler on and off and allow program quantities to be entered.
- 8.6 Program Controls – The right column of six red keys make up the program controls
  - 8.6.1 Pressing the PROGRAM/STEP PROGRAM key will cause the sampler to be transferred from the standby state to the program state. This key can also be used in place of the ENTER VALUE key as it contains an implied value. Therefore, after entering quantities using the numeric keypad, pressing the PROGRAM/STEP PROGRAM key will cause the displayed value to be entered and the indicator light to advance to the next step. Pressing this key five times while the program is in the run state will cause the sampler to automatically scan the indicator lights. This allows the settings of the program to be scanned quickly.
  - 8.6.2 Pressing the ENTER VALUE key will cause the value shown on the display to be entered into the memory. However, there is seldom a need to use the key, as the PROGRAM/STEP PROGRAM key will also enter the value and advance to the next indicator light.
  - 8.6.3 Pressing the CLEAR ENTRY key will cause a newly entered value to be replaced by the previous value. If no new value has been entered, pressing this key will cause the sampler to be transferred from the program state to the standby state. This allows for a

quick exit from the program state without going through all the indicator lights.

- 8.6.4 Pressing the START PROGRAM/START SAMPLING key will initiate the sampling program.
- 8.6.5 Pressing the HALT PROGRAM/HLT SAMPLING key suspends the sampling program. Time incrementing continues even while the program is halted. If the time interval reaches zero in this state, no sample will be collected and no memory of the missed sample is retained.
- 8.6.6 Pressing the RESUME PROGRAM/RESUME SAMPLING key causes the current program to continue. This key is normally used to resume a program that has been temporarily halted.
- 8.7 LCD display – Refer to the appropriate instruction manual to see examples of the various readings that would be displayed depending upon what state the sampler is in. In addition, the manuals provide details on various error messages that may appear on the display.
- 8.8 Programming steps – A series of indicator lights are present on the Model 2710 to “step” the user through the programming process. The same information is present on the control panel of the Model 2910, although there are no indicator lights. The Model 2910 contains step descriptions only.
  - 8.8.1 MODE – The two modes available and their corresponding numbers are: 1=Time, 2=Flow.
  - 8.8.2 INTERVAL BETWEEN SAMPLES – The time intervals between samples is set in minutes. Any value between 1 and 9999 minutes may be entered.
  - 8.8.3 DELAY TO FIRST/NEXT SAMPLE – The time to the first sample may be selected independent of the normal interval between samples. Often the delay is set for one minute so that the first sample collection can be observed. The second sample would be collected later, after the programmed interval. This allows the user to verify the unit is functioning and check sample volumes.
  - 8.8.4 NOMINAL SAMPLE VOLUME – The sample volume is programmed in 10’s of milliliters. Therefore, an entry of 15 would result in approximately 150-ml. (15 x 10) sample. An entry of zero will put you in the Calibrate Sample Volume Mode.

- 8.8.5 TYPE OF SUCTION LINE – Four types of tubing and their corresponding numbers are listed on the control panel. You will primarily use numbers 3 and 4. These numbers indicate 3/8" ID tubing is used in either 10' or 25' lengths.
- 8.8.6 SUCTION HEAD – The approximate suction head should be rounded up to the nearest whole number in terms of feet and entered into the program. (Note: Refer to how a sampler determines volumes in Sampling Considerations - Section 5.0.)
- 8.8.7 CALIBRATE SAMPLE VOLUME – This step will be skipped unless you have entered a 0 under Nominal Sample Volume.
- 8.8.8 NUMBER OF SAMPLES/NUMBER OF COMPOSITE SAMPLES – The number of samples collected is selected by entering any value between 1 and 999. For example, if you were collecting 1 sample every 30 minutes for a 24-hour period, the number entered would be 48. This will cause the sampler to shut off after the 48<sup>th</sup> sample is collected.
- 8.9 Example of a Typical Sampling Program Using the Model 2710 or 2910
  - 8.9.1 Connect power source and press ON key. This will place the sampler in the standby mode.
  - 8.9.2 Press PROGRAM/STEP PROGRAM key. For the rest of the programming process, you will press the PROGRAM/STEP PROGRAM key after each procedure to enter the programmed value and advance to the next step.
  - 8.9.3 TIME: Enter 1 on the numeric keypad to select Time Mode. Advance.
  - 8.9.4 INTERVAL BETWEEN SAMPLES: Enter 30 on the numeric keypad. Advance.
  - 8.9.5 DELAY TO FIRST/NEXT SAMPLE: Enter 1 on the numeric keypad. Advance.
  - 8.9.6 NOMINAL SAMPLE VOLUME: Enter 20 on the numeric keypad. This will result in approximately 200 mils of sample in each collection. Advance.
  - 8.9.7 TYPE OF SUCTION LINE: Enter 3 on the numeric keypad. This indicates 3/8" ID diameter tubing that is 10' in length. Advance.

8.9.8 SUCTION HEAD: Enter 6 on the numeric keypad. Advance.

8.9.9 NUMBER OF COMPOSITE SAMPLES: Enter 48 on the numeric keypad. Advance.

8.9.10 The last depression of the PROGRAM/STEP PROGRAM key placed the sampler in the standby state. Press the START PROGRAM key to begin the sampling sequence.

#### 8.10 Maintenance Procedures for the Models 2710 and 2910

8.11.1 There are no routine maintenance procedures recommended for the Model 2710 or 2910.

8.11.2 If the HUMIDITY INDICATOR (located on the control box) indicates the presence of moisture inside the control box, the control box should be inspected to determine if there is a leak and if the desiccant should be renewed. Refer to the instruction manual for instructions on when and how to renew or replace desiccant.

### 9.0 MODEL 2700 AND 2900 SEQUENTIAL SAMPLER

9.1 It is suggested that you have a sampler present while reviewing these instructions in order to facilitate learning. Photographs of the Model 2700 and 2900 control panels are included as Figures 5 and 7, respectively. If you have questions after reviewing these procedures, refer to the manufacturer's instruction manual.

9.2 Models 2700 and 2900 are both discussed in this section because they are utilized for similar applications. In addition, the control panels and programming options are very similar.

9.3 The Model 2700 and 2900 are primarily utilized to collect discrete samples, but both models can be equipped to collect composite samples.

9.4 Manual Controls – The left column of six blue keys are the manual controls.

9.4.1 Pressing the MANUAL SAMPLE key while in the standby state will cause a sample to be collected according to the sampler's current program.

9.4.2 Pressing the DISTRIBUTOR ADVANCE (Model 2700) or NEXT BOTTLE (Model 2900) key while the sampler is in the standby state will cause the distributor to advance to the next bottle. There is a 1:1 ratio between the number of times the key is depressed and

the number of bottles that the distributor will advance. Advancing past the 24<sup>th</sup> bottle will reset the distributor.

- 9.4.3 Pressing the PUMP JOG FORWARD key will cause the pump to draw fluids as long as the key is depressed.
- 9.4.4 Pressing the PUMP JOG REVERSE key will cause the pump to expel fluids as long as the key is depressed.
- 9.4.5 Pressing the PUMP CONTINUOUS FORWARD key will cause the pump to draw fluids continuously. The sampler must be in the standby state.
- 9.4.6 Pressing the PUMP STOP key will cause the pump to stop immediately. (Note: The PUMP STOP key is red on Model 2900)

(Note: The PUMP JOG FWD, PUMP JOG REV, and PUMP STOP keys will all work in either the standby or program state. This enables you to manually calibrate a sample when sample volumes are critical. Directions for manual calibration can be found in the instruction manual.)

- 9.5 Numeric Keypad – The twelve keys in the center of the control panel make up the numeric keypad. These turn the sampler on and off, and allow program quantities to be entered.
- 9.6 Program Controls – The right column of six red keys make up the program controls.
  - 9.6.1 Pressing the PROGRAM/STEP PROGRAM key will cause the sampler to be transferred from the standby state to the program state. This key may also be used in place of the ENTER VALUE key as it contains an implied value. Therefore, after entering quantities using the numeric keypad, pressing the PROGRAM/STEP PROGRAM key will cause the displayed value to be entered and the indicator light to advance to the next step. Pressing this key five times while the program is in the run state will cause the sampler to automatically scan the indicator lights. This allows the settings of the program to be scanned quickly.
  - 9.6.2 Pressing the ENTER VALUE key will cause the value shown on the display to be entered into the memory. However, there is seldom a need to use this key since the PROGRAM/STEP PROGRAM key will also enter the value and advance to the next indicator light.

- 9.6.3 Pressing the CLEAR ENTRY key will cause a newly entered value to be replaced by the previous value. If no new value has been entered, pressing this key will cause the sampler to be transferred from the program state to the standby state. This allows for a quick exit from the program state without going through all the indicator lights.
- 9.6.4 Pressing the START PROGRAM/RESET DISTRIBUTOR (Model 2700) or START SAMPLING (Model 2900) key will cause the distributor to reset and the program to begin.
- 9.6.5 Pressing the HALT PROGRAM/HALT SAMPLING key will stop the program while it is in operation. Time intermitting will continue even while it is halted. If the time interval reaches zero while in this state, no sample will be collected and a missed sample is not remembered.
- 9.6.6 Pressing the RESUME PROGRAM/RESUME SAMPLING key will cause the program to run as it currently exists. The distributor is not reset. This key is normally used to resume a program that has been temporarily halted.
- 9.7 LCD Display – Refer to the appropriate instruction manual to see examples of various readings that are displayed. In addition, the manuals provide details on various error messages that may appear on the display.
- 9.8 Programming steps – A series of indicator lights are present on the Model 2700 to “step” the user through the programming process. The same information is present on the control panel of the Model 2900, although there are no indicator lights. The Model 2900 contains step descriptions only.
  - 9.8.1 MODE – There are six modes available on both the Model 2700 and Model 2900. Their corresponding numbers are listed on the control panels.
  - 9.8.2 INTERVAL BETWEEN SAMPLES – The time intervals between samples is set in minutes. Any value between 1 and 9999 minutes may be entered.
  - 9.8.3 DELAY TO FIRST/NEXT SAMPLE – The time to the first sample may be selected independent of the normal interval between samples. Often the delay is set for one minute so that the first sample collection can be observed. The second sample would be collected later, after the programmed interval. This allows the user to verify the unit is functioning and check sample volume.



- 9.8.4 NOMINAL SAMPLE VOLUME – The sample volume is programmed in 10's of milliliters. Therefore, an entry of 15 would result in approximately 150-ml (15 x 10) of sample collected. The maximum setting in this mode is 99, which would result in a 990-ml sample. Care should be taken not to overfill the sample bottle. An entry of 0 while in the mode will put you in the Calibrate Sample Volume mode. Directions for manually calibrating a sample are found in the instruction manual.
- 9.8.5 TYPES OF SUCTION LINE – Four types of lines are available. Their corresponding numbers are listed on the control panel.
- 9.8.6 SUCTION HEAD – The approximate suction head should be rounded up to the nearest whole number in terms of feet and entered into the program.
- 9.8.7 MULTIPLEX MODE – The following three modes are available: 1) off, 2) bottles per sample and 3) samples per bottle. For ESP purposes, the multiplex mode will usually be in the OFF position.
- 9.8.8 MULTIPLEX NUMBER - The number of consecutive bottles to be filled or the number of samples to placed in a single bottle can be programmed in this mode. This light is skipped if the multiplex mode is in the off position.
- 9.8.9 CALIBRATE SAMPLE VOLUME – This mode will be skipped unless you have entered a 0 under Nominal Sample Volume.
- 9.8.10 NUMBER OF COMPOSITE SAMPLES – The number of samples collected is selected by entering any value between 1 and 999. For example, if you were collecting 1 sample every 30 minutes for a 24-hour period, the number entered would be 48. This will cause the sampler to shut off after the 48<sup>th</sup> sample is collected. This light will be skipped if the sampler is operating in the sequential mode.
- 9.9 Example of a Typical Sampling Program Using the Model 2700 or 2900 in the Sequential Time Mode
  - 9.9.1 Connect power source and press the ON key.
  - 9.9.2 Press PROGRAM/STEP PROGRAM key. For the rest of the programming process, you will press the PROGRAM/STEP PROGRAM key after each procedure to enter the programmed value and advance the indicator light.

- 9.9.3 TIME: Enter 1 on the numeric keypad to put you in the Seq. Time mode. Advance.
- 9.9.4 INTERVAL BETWEEN SAMPLES: Enter 60 on the numeric keypad. Advance.
- 9.9.5 DELAY TO FIRST/NEXT SAMPLE: Enter 3 on the numeric keypad. This will give you enough time to get through the programming sequence before the first sample is collected. Advance.
- 9.9.6 NOMINAL SAMPLE VOLUME: Enter 50 on the numeric keypad. This will result in approximately 500 ml of sample in each collection. Advance.
- 9.9.7 TYPE OF SUCTION LINE: Enter 3 on the numeric keypad. This indicates 3/8" ID tubing that is 10' long. Advance.
- 9.9.8 SUCTION HEAD: Enter 6 on the numeric keypad, indicating 6' of vertical lift in the suction line. Advance.
- 9.9.9 MULTIPLEX MODE: Enter 1 on the numeric keypad, turning the Multiplex Mode off. Advance.
- 9.9.10 The last depression of the PROGRAM/STEP PROGRAM key placed the sampler in the standby state. Press the START PROGRAM/RESET DISTRIBUTOR key to place the sampler in the run state.

#### 9.10 Maintenance Procedures for the Models 2700 and 2900

- 9.10.1 There are no routine maintenance procedures recommended for the Model 2700 or 2900.
- 9.10.2 If the HUMIDITY INDICATOR (located on the control box) indicates the presence of moisture inside the control box, the control box should be inspected to determine if there is a leak and if the desiccant should be renewed. Refer to the instruction manual for instructions on when and how to renew or replace desiccant.

#### 10.0 MODEL 6700 COMPOSITE/SEQUENTIAL SAMPLER

- 10.1 The Model 6700 is much more sophisticated than all other automated samplers currently in use at ESP. Typically, this model is only utilized for specialized sampling situations since programs can be created for complex applications. For this reason it is not practical to discuss Model 6700

programming controls and options in this document. The user should refer to the owners manual located in the WQMS for this information.

## 10.2 General Considerations of the Model 6700

10.2.1 The Model 6700 requires unique pump tubing, which is not utilized on the other (older) ISCO samplers discussed in this SOP.

10.2.2 The Model 6700 is primarily utilized by ESP staff as a sequential sampler, but can be converted to a composite sampler.

10.2.3 The Model 6700 can be equipped with 1, 4, 8, 12 or 24 individual sample bottles. Currently, ESP has the equipment necessary to operate the unit as a composite sampler (with 1 bottle) or as a sequential sampler using 24 individual bottles.

10.2.4 The Model 6700 can be equipped with a liquid level actuator, Sonde (temp, pH, DO, SC), rain gauge, or flow meter.

10.3 Unlike other ISCO samplers discussed in this SOP, the Model 6700 program controls are selected from a menu displayed on a LCD viewing screen. Lists of programming options are present on numerous menus that can be accessed using the keypad. Note that a photograph of the Model 6700 control panel is included as Figure 9. Due to the large number of programming options, they cannot be thoroughly discussed in this SOP. Refer to the instruction manual for more information.

## 10.4 Maintenance Procedures for the Model 6700

10.4.1 The sampler is programmed to prompt the user to replace an internal battery. A lithium battery housed inside the controller maintains power to the sampler's memory when the controller is disconnected from a power source. If the internal battery discharges completely, the sampler will lose all program settings and all data stored in memory.

10.4.2 If the HUMIDITY INDICATOR (located on the control box) indicates the presence of moisture inside the control box, the control box should be inspected to determine if there is a leak and if the desiccant should be renewed. Refer to the instruction manual for instructions on when and how to renew or replace desiccant.

## 11.0 SET-UP PROCEDURES FOR SAMPLING ORGANIC PARAMETERS WITH ISCO SAMPLERS

11.1 Any of the ISCO composite samplers discussed in this SOP may be used to sample organic parameters commonly found in various discharges. Specific methods must be used when sampling for these parameters, such as properly cleaned glass containers, Teflon intake lines, and Teflon or stainless steel intake strainers.

11.2 The HDPE containers should be removed from the samplers and replaced with a designated 2.5-gallon glass jar. Inserts are available that can be placed in the tubs, which will hold the glass sample jar securely in place.

11.2.1 The glass sample jar and lid must be cleaned appropriately using the following technique.

- Wash the glass jar with warm water and soap (alconox or liquinox). Triple rinse with deionized water.
- Then, wash the glass jar with nitric acid and triple rinse with deionized water.
- Then, wash the glass jar with acetone or hexane and triple rinse with deionized water.
- Allow the glass jar to air dry.
- Wrap in aluminum foil for transport to the sampling destination.

11.3 Unscrew the pump cover and remove used silicone tubing. Replace with new tubing according to manufacturer's instructions.

11.4 Remove dirty Tygon tubing and the stainless steel barrel that connects the Tygon and silicon pump tubing. Replace with Teflon tubing. (Note: The Teflon tubing has a smaller outer diameter than the Tygon tubing. It can be fitted tightly to the silicone pump tubing by inserting it directly into the silicone tubing. A hose clamp is useful to ensure the hoses do not separate during sampling, but no steel barrel connector is required.)

11.5 A Teflon or stainless steel strainer must be used when sampling organics. The strainers should be washed and handled in the same manner as the glass sample containers described in Section 11.2.1.

## 12.0 GENERAL CLEANING PROCEDURES FOR ISCO SAMPLERS

12.1 Cleaning Procedures for composite samplers

- 12.1.1 Wash sample jug with warm, soapy water. Rinse thoroughly with deionized water and place upside down to drain.
  - 12.1.2 Wash down the outside of the Tygon tubing and scrub strainer or aluminum pipe with brush. If strainer is very dirty, use test tube brush to clean holes in strainer body or dismantle strainer to clean.
  - 12.1.3 Attach a power pack to the sampler and pump warm, soapy water through the Tygon and pump tubing for at least 30 seconds. Next, rinse the tubing by pumping deionized water through. Finally, place the pump in reverse and drain the excess water from the tubing.
  - 12.1.4 Position the strainer inside the top cover and place the sampler on the storage shelf. (Note: The strainer should be placed outside the top cover on dirty samplers. Dirty samplers should not be placed on the storage shelf.)
- 12.2 Cleaning Procedures for sequential samplers
- 12.2.1 Remove dirty bottles from the tub and wash with warm, soapy water. Rinse each bottle with deionized water.
  - 12.2.2 Remove the distributing funnel plate from the bottom of the pump section. This is accomplished by unscrewing the retaining nut and pulling the funnel plate straight off the funnel key. Wash the plate with warm, soapy water. Scrub each port with a bottlebrush. Rinse with deionized water. When replacing the distributor plate, make sure the retaining nut is screwed on firmly.
  - 12.2.3 Wash the outside of the Tygon tubing and scrub strainer or aluminum pipe with brush. If the strainer is very dirty, use test tube brush to clean holes in strainer body or dismantle strainer to clean.
  - 12.2.4 Attach power pack to sampler and pump warm, soapy water through the tubing for at least 30 seconds. Next, rinse the tubing by pumping deionized water through. Finally, drain any excess water from the tubing.
  - 12.2.5 Place the sampler in the automatic mode. Run the SAMPLE INTERVAL switch to zero and simultaneously push the PRESS TO SET DELAY button and the PRESS TO READ DISPLAY button. This will cause the sampler to collect a sample according to the program. Reset the SAMPLE INTERVAL switch to one minute. Press the SET DELAY button and see if the sampler

collects a sample automatically. After the pump has stopped, press the MANUAL ADVANCE button continuously until the distributor funnel plate stops. The STANDBY position should appear in the viewing port. This procedure assures that the automatic sampling cycle is functioning properly and that the funnel plate is properly aligned. Refer to maintenance procedures if the sampler does not perform as expected.

### 13.0 SET-UP PROCEDURES FOR COLD WEATHER SAMPLING

- 13.1 Automatic samplers can be utilized during the winter, but should not be used when temperatures are expected to drop much below 10 degrees Fahrenheit.
- 13.2 For winter operation, the following precautions should be taken to avoid freezing of the sampler.
  - 13.2.1 Shorten the intake line to the minimum amount needed and position the tubing such that all water drains after each sample aliquot is collected.
  - 13.2.2 Make certain the batteries are fully charged.
  - 13.2.3 Decrease the time interval between sample collections to help keep lines, etc., from freezing.
  - 13.2.4 If possible, place sampler in a shelter or building to avoid exposure.
- 13.3 It should be noted that the ice should be placed in the base section in order to cool the collected sample, even during freezing temperatures.

### 14.0 REFERENCES

ISCO Instruction Manual – Model 1580 Sampler, 1976  
ISCO Instruction Manual – Model 1680 Sampler, 1975  
ISCO Instruction Manual – Model 2700 Sampler, 1986  
ISCO Instruction Manual – Model 2710 Sampler, 1986  
ISCO Instruction Manual – Model 2900 Sampler, 1996  
ISCO Instruction Manual – Model 2910 Sampler, 1995  
ISCO Instruction Manual – Model 6700 Portable Samplers, 1997  
ISCO Instruction Manual – Model 1640 Liquid Level Sampler Actuator, 1987

Figure 1 – Basic Components of an ISCO Automated Sampler

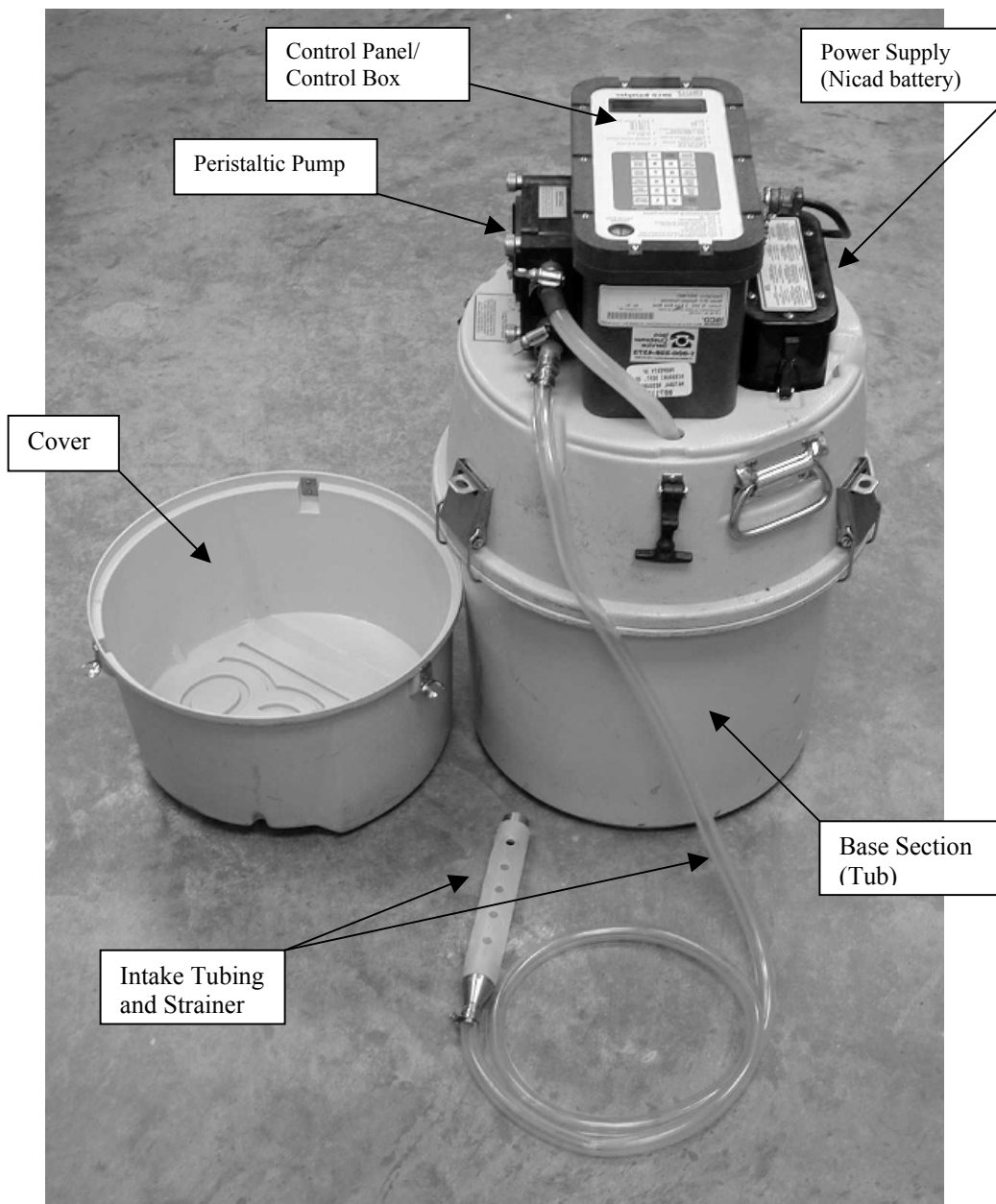


Figure 2 - Sequential (Discrete) and Composite Sample Containers

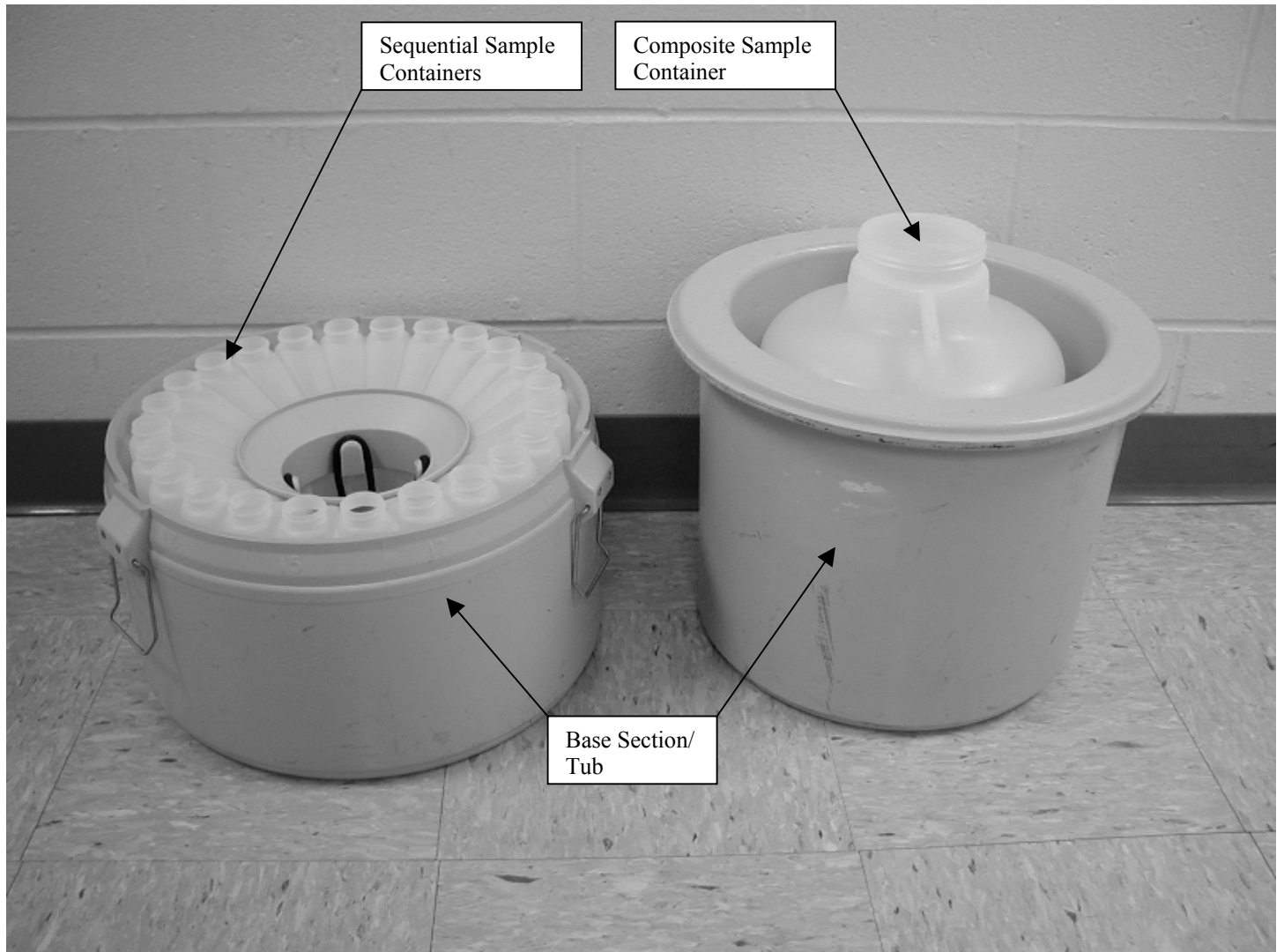




Figure 3 - Model 1580 Control Panel

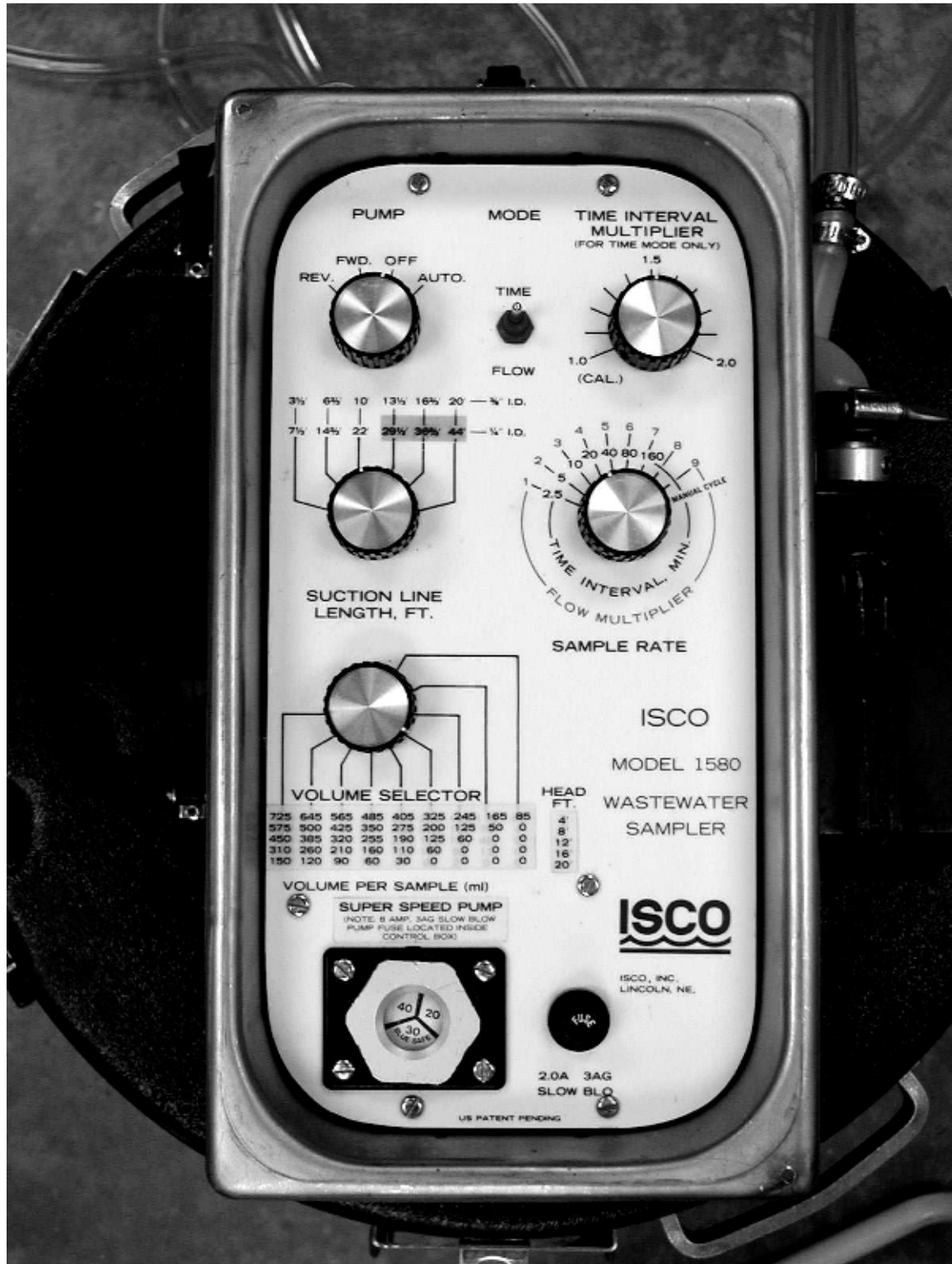


Figure 4 - Model 1680 Control Panel



Figure 5 - Model 2700 Control Panel





Figure 6 - Model 2710



Figure 7 – Model 2900 Control Panel



Figure 8 – Model 2910 Control Panel





Figure 9 – Model 6700 Control Panel

